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Distribution patterns of
Southern African Muridae,
with notes on some of their
fossil antecedents

INTRODUCTION

In this preliminary attempt to define faunal areas on the basis of the distribution patterns of the species of Muridae occurring in Southern Africa, the problem has been approached with the Aethiopian Geographical Region as background and with the simplest classification of biotic zones based on the major vegetation types as a starting point. The murids of Southern Africa (south of the Kunene-Zambezi) show varying degrees of attachment to the biotic zones Savanna, South West Arid and South-West Cape (Fig. 1). A consideration of their distribution within these zones brings to light a degree of correspondence sufficiently close to give reality to the approach made here of taking vegetation types as a starting point. Subdivisions of the zones, especially of the diversified Savanna zone, on the basis of murid distribution gives even more support for regarding vegetation as the most meaningful ecological summary of the influences of soil, climate, topography and other static and dynamic environmental factors.

BIOTIC SUBDIVISIONS OF THE AETHIOPIAN GEOGRAPHICAL REGION

Sclater (1896) divided the Aethiopian Region into four: The Saharan, West African, Cape and Malagasy subregions. In recent years the Malagasy subregion has been given regional status (Darlington 1957). The Aethiopian Region may thus be defined as continental Africa south of the Sahara. Sclater's Cape subregion extended to the fringes of the Congo Basin in the north-west and to the Tana watershed (just north of the equator) in the north-east where it graded into the Saharan subregion. That there is some significance in this meeting point (here termed the Sclater line) of his two subregions will become apparent below (see p. 62). Chapin (1923, 1932) worked out avifaunal subdivisions largely on the basis of vegetation types which he found best fitted the distribution of birds. His West African subregion and East and South African subregion correspond essentially to those of Sclater's—understandably, since both are based on the broad separation of tropical forest from savanna and desert.

The map reproduced here (Fig. 1) is based on that of Moreau (1952) which is a simplification of Chapin's map, but with Moreau's addition of the south-western Cape winter

rainfall (Cape macchia) as a distinct biotic subregion. The boundaries of the vegetation zones in Fig. 1 are slightly modified from Moreau to conform with the recently published vegetation map of Africa south of the tropic of Cancer (Keay 1959) but the names used by Moreau for the subregions are retained.

SOUTHERN AFRICA AS A FAUNAL AREA

The northern boundary

As can be seen from Fig. 1 the South West Arid lies to the south of the Kunene-Zambezi boundary with the important exception that there is a tongue along the west coast, penetrating into southern Angola across the Kunene River. South West Arid mammals penetrate to 12° S. (Hill and Carter 1941) and this point also coincides with the northern limit of the biotic zone as delimited on the basis of vegetation. Koch (1958) for example has shown that the Kunene River in itself is no barrier to the Tenebrionidae and that the subdivision extends certainly to 15° S. and probably to 12° S. The Kunene River turns northwards in longitude 15° E. and from that point the boundary follows international borders to the Zambezi at Katima Mulilo, Caprivi Strip. There is thus no natural barrier until the Zambezi is reached. This stretch of country however, is a transition belt between the South West Arid and the Savanna zone and in this sense has some meaning faunistically.

The biotic zones in Southern Africa

The South-West Cape.—The South-West Cape is distinct climatically and biotically. The south-western portion has a strictly Mediterranean climate with winter rainfall. Towards the east, along the coast as far as Port Elizabeth, annual rainfall becomes more and more regularly distributed throughout the year. The zone is cut off from the Karoo section of the South West Arid by the northern limit of the Folded Belt; from the Savanna by the George-Knysna forests and from the southern Namib by the transition to the Cape macchia. The zone as delineated on the map (Fig. 1) corresponds to the Cape macchia.

The South West Arid.—The South West Arid lies in the under 20 inch rainfall area and consists of true desert (the Namib) and semi-desert (Kalahari and Karoo). It is divided across the middle by the Orange River and contains within it the western and southern portions of the Great Escarpment. It extends across the Kunene to about latitude 12° S.

Southern Savanna.—After sweeping across the subcontinent the Southern Savanna occupies the eastern part of Southern Africa and continues down the east coast to meet the South-West Cape. It contains the rest of the Great Escarpment running northwards to the Zambezi River with its montane grasslands and forest patches, as well as the highveld grasslands and the bush-and lowveld woodlands and the low-lying tropical Mozambique Plain.

Forest.—Isolated patches of montane and subtropical evergreen forest are distributed in the Savanna zone and in the South-West Cape, mainly below the Great Escarpment from Southern Rhodesia to the Cape. Endemic species of mammals are extremely few in number. No species of Muridae is a true forest form. There are thus no ecological equivalents in Southern Africa to such species that Ansell (1960) lists either as encroaching marginally into Northern Rhodesia from Lowland Forest or as having a relict distribution outside their main distribution area in the Lowland Forest.

ENDEMISM AND DISTRIBUTION PATTERNS OF THE MURIDAE

Roberts (1937; 1951, p., xxii-xxiv) went into the question of endemism, of ancient and modern genera and of the significance of their ranges. His analysis of distribution is in somewhat general terms and since he published no distribution maps it is difficult to arrive at a classification of distribution patterns from his book. Now that detailed maps have been

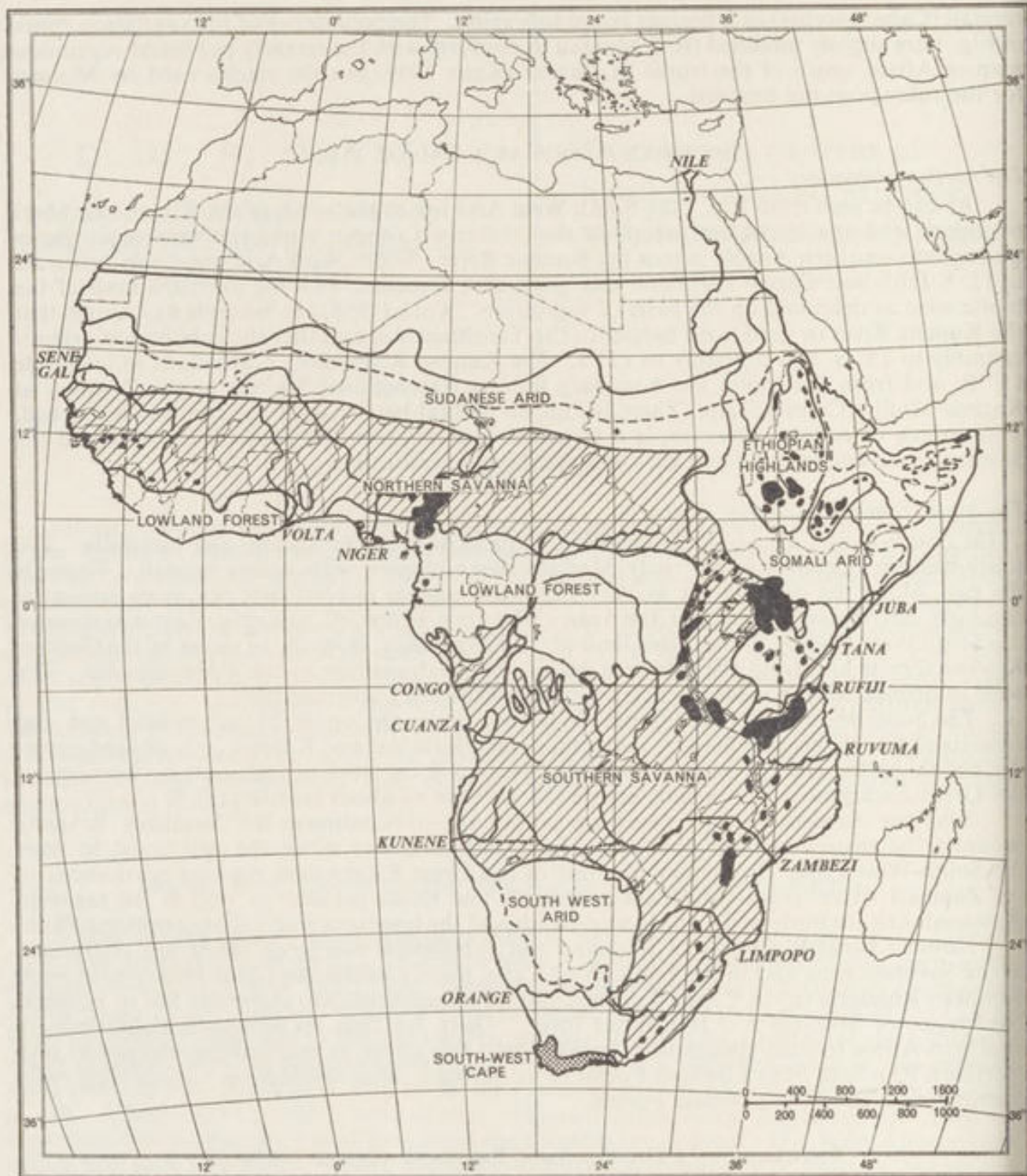


Fig. 1. The main biotics zones of Africa south of the Sahara. Montane forest in black. (After Moreau 1952 and Keay 1959).

compiled it is instructive and revealing to approach the problem of making subdivisions of the biotic zones of Southern Africa from the point of departure taken by Ansell (1960) and to make a preliminary classification of the distribution patterns of the Muridae on the basis of endemism, marginal encroachment and relict populations. It must be borne in mind that the taxonomic status of the species mapped here is in some cases still uncertain and that the distribution records for many are incomplete, especially those which extend beyond Southern Africa.

Ansell (1960) classifies the 191 species of mammals amongst which he recognises 36 species of indigenous Muridae found in Northern Rhodesia according to their distribution patterns using Chapin's two main faunal subdivisions as a framework. He points out that Northern Rhodesian species typical of the West African subregion (Lowland Forest of Fig. 1) have two patterns: the one a relict pattern, with discontinuities determined by the existence in the past of more extensive forest during one or other of the Pleistocene Pluvials and the other a marginal encroachment from the Lowland Forest block. The savanna species of his East and South African subregion (Northern and Southern Savanna of Fig. 1, which extends across the continent below the Sahara to West Africa) either extend throughout the subregion, with some reaching the Palaearctic or have a restricted distribution within it, sometimes continuous, sometimes discontinuous. Other species are grouped as occurring throughout the Region, a few of which extend into the Palaearctic.

The categories employed by Ansell (1960) to classify the ranges of Northern Rhodesian mammals, i.e. as endemic, marginal or relict, have here been applied to the species of Muridae occurring in Southern Africa.

SPECIES-ASSEMBLAGES OF THE BIOTIC ZONES

The South-West Cape (Table 1).—There are three species of Muridae which are endemic to the South-West Cape viz. *Praomys verreauxi*, *Acomys subspinosus* and *Tatera afra*. The following species are represented by fairly distinct subspecies or isolated relict populations: *Dasmys incomtus* (ssp. *capensis*), *Saccostomus campestris*, *Steatomys* sp., *Otomys laminatus* (ssp. *silbibaueri*), *O. saundersiae* (ssp. *karoensis*) and *Mystromys albicaudatus*. All but *S. campestris* are Savanna species, one of which, *D. incomtus*, extends throughout the Southern and Northern Savanna to West Africa. The remaining species may be classified as encroaching on the South-West Cape from their main distribution area without marked discontinuities in distribution.

South West Arid (Table 2).—There are ten species which are either confined to the South West Arid or range only slightly outside it: *Zelotomys woosnami*, *Aethomys granti*, *Petromyscus collinus*, *Malacothrix typica*, *Otomys unisulcatus*, *Parotomys brantsi*, *P. littledalei*, *Desmodillus auricularis*, *Gerbillus paeba* and *G. vallinus*. All but *M. typica*, *O. unisulcatus*, *P. brantsi*, *D. auricularis* and *G. paeba* are strictly confined to the subregion. Species with isolated relict populations of subspecies status are: *O. irroratus* (ssp. *coenosus* at Kuruman and an isolated population in the Upper Karoo), *O. sloggetti* (ssp. *sloggetti*), *Tatera brantsi* (ssp. *namaquensis* on lower Orange River and ssp. *miliaria* in the Upper Karoo). The other species have substantial ranges in this and the Savanna zone.

Almost every one of the species found in the South West Arid has a different pattern within the subregion. The subdivision of the South West Arid on the basis of the distribution patterns of the Muridae would divide it at least into the following sub-zones: northern (e.g. *P. littledalei* ssp. *namibensis*), and southern Namib; the western Escarpment and associated upland mountain blocks (*P. collinus*); the Kalahari basin (*T. b. perpallida*, *T. l. schinzi*, *Z. woosnami*) and the Karoo (*A. granti* and *O. unisulcatus*).

TABLE 1
DISTRIBUTION STATUS OF MURIDAE OCCURRING IN THE SOUTH-WEST CAPE
BIOTIC ZONE

<i>Endemic</i>	<i>Relict*</i>	<i>Marginal</i>
1. <i>Praomys verreauxi</i>	.....	.....
2. ....	.....	<i>Praomys natalensis</i>
3.	<i>Dasymys incomtus</i>	.....
4. ....	.....	<i>Aethomys namaquensis</i>
5. ....	.....	<i>Rhabdomys pumilio</i>
6. ....	.....	<i>Mus minutoides</i>
7. <i>Acomys subspinosus</i>	.....	.....
8.	<i>Saccostomus campestris</i>	.....
9.	<i>Steatomys</i> sp.	.....
10. ....	.....	<i>Dendromus mesomelas</i>
11. ....	.....	<i>Dendromus melanotis</i>
12. ....	.....	<i>Malacothrix typica</i>
13.	<i>Otomys laminatus</i>	.....
14. ....	.....	<i>Otomys irroratus</i>
15.	<i>Otomys saundersiae</i>	.....
16. ....	.....	<i>Otomys unisulcatus</i>
17. ....	.....	<i>Parotomys brantsi</i>
18.	<i>Mystromys albicaudatus</i>	.....
19. ....	.....	<i>Desmodillus auricularis</i>
20. ....	.....	<i>Gerbillus paeba</i>
21. <i>Tatera afra</i>	.....	.....

*Species with isolated subspecies or populations whose main distribution is elsewhere.

TABLE 2
DISTRIBUTION STATUS OF MURIDAE OCCURRING IN THE SOUTH WEST ARID
BIOTIC ZONE

<i>Endemic (A)</i>	<i>Near-endemic (B)*</i>	<i>Relict</i>	<i>Marginal†</i>
1.	<i>Thallomys paedulus</i> ‡
2. <i>Zelotomys woosnami</i> (A)
3.	<i>Aethomys chrysophilus</i> ‡
4.	<i>Praomys natalensis</i>
5.	<i>Aethomys namaquensis</i>
6. <i>Aethomys granti</i> (A)
7.	<i>Rhabdomys pumilio</i>
8.	<i>Mus minutoides</i>
9.	<i>Lemniscomys griselda</i> ‡
10.	<i>Saccostomus campestris</i> ‡
11. <i>Petromyscus collinus</i> (A)
12.	<i>Steatomys</i> spp.
13.	<i>Dendromus melanotis</i>
14. <i>Malacothrix typica</i> (B)
15.	<i>Otomys irroratus</i>	.....
16. <i>Otomys unisulcatus</i> (B)
17.	<i>Otomys sloggetti</i>	.....
18. <i>Parotomys brantsi</i> (B)
19. <i>Parotomys littledalei</i> (A)
20. <i>Desmodillus auricularis</i> (B)
21. <i>Gerbillus paeba</i> (B)
22. <i>Gerbillus vullinus</i> (A)
23.	<i>Tatera brantsi</i> ‡
24.	<i>Tatera leucogaster</i>

*Near-endemic (B), in this table, means limited marginal encroachment into either South-West Cape and/or Savanna.

†Marginal here used in a very broad sense to list Savanna species, most of which have substantial ranges in the South West Arid.

‡Species encroaching marginally, but also with isolated relict subspecies or populations.

Savanna species (Table 3).—The Savanna zone is much more diversified and extensive than the South West Arid and South-West Cape and it is not surprising therefore that there are few species that can be said to be strictly endemic. *Thamnomys dolichurus* is a Savanna endemic but it is, to some extent, dependent upon the proximity of forest. Those Savanna forms that do not penetrate the South West Arid, but reach the South-West Cape along the coast (e.g. *Dasymys incomtus*, *O. laminatus*, *O. irroratus*, *O. saundersiae* and *M. albicaudatus*) form one group. Those that range fairly extensively in the South West Arid, but which are primarily Savanna forms are: *T. paedulus*, *A. chrysophilus*, *A. namaquensis*, *R. pumilio*, *M. minutoides*, *L. griselda*, *S. campestris*, *O. sloggetti* and *T. leucogaster*. A further group are those Savanna species whose ranges terminate higher up in the Savanna belt e.g. *Cricetomys gambianus* (relict populations in northern Transvaal and Mozambique) and *Pelomys fallax*.

TABLE 3
DISTRIBUTION STATUS OF MURIDAE OCCURRING IN THE SAVANNA BIOTIC ZONE

Endemic (A) Near-endemic (B)*	Relict	Marginal
1. <i>Thamnomys dolichurus</i> (A)
2. <i>Aethomys chrysophilus</i> (B)
3. <i>Thallomys paedulus</i> (B)
4. <i>Praomys natalensis</i> (B)
5. <i>Aethomys namaquensis</i> (B)
6. <i>Rhabdomys pumilio</i> (B)
7. <i>Mus minutoides</i> (B)
8. <i>Dasymys incomtus</i> (B)
9. <i>Pelomys fallax</i> (A)
10. <i>Lemniscomys griselda</i> (B)
11. <i>Acomys</i> spp. (A)
12. <i>Saccostomus campestris</i> (B)
13. <i>Cricetomys gambianus</i> (A)
14. <i>Steatomys</i> spp. (B)
15. <i>Dendromus mesomelas</i> (B)
16. <i>D. mystacalis</i> (A)
17. <i>D. melanotis</i> (B)
18. <i>D. nyikae</i> (A)
19.	<i>Malacothrix typica</i>
20. <i>Otomys laminatus</i> (B)
21. <i>Otomys irroratus</i> (B)
22. <i>Otomys angoniensis</i> (A)
23. <i>Otomys saundersiae</i> (B)
24. <i>Otomys sloggetti</i> (B)
25. <i>Mystromys albicaudatus</i> (B)
26.	<i>Desmodillus auricularis</i>
27.	<i>Gerbillus paeba</i>	.....
28. <i>Tatera inclusa</i> (A)
29. <i>Tatera brantsi</i> (B)
30. <i>Tatera leucogaster</i> (B)

*Near-endemic in this table means a fairly substantial hold either in South West Arid and/or South-West Cape.

NOTES ON THE DISTRIBUTION PATTERNS AND HABITAT PREFERENCES OF THE MURIDAE

Subfamily Murinae

1. *Thamnomys dolichurus* (Fig. 5, Map 23; Table 3): Confined to Savanna woodland and extending through the Southern and Northern Savanna to West Africa; dependent upon thickets and forest margins. Funnels down south-east coastal belt to Uitenhage district.

2. *Aethomys chrysophilus* (Fig. 7, Map 31; Tables 2, 3): A Savanna woodland species occurring in Southern Savanna to Kenya (Sclater line). Distribution pattern defines transition from grassland to woodland in Natal and Transvaal. Relict population in South West Arid around Kuruman and marginal from Savanna zone into north-western Kalahari.
3. *Thallomys paedulus* (Fig. 7, Map 34; Tables 2, 3): From Orange River northwards through South West Arid and Southern Savanna to equator (Sclater line). Dependent upon camelthorn and other *Acacia* groves in South West Arid (*nigricauda* group of 'subspecies') and on woodland in bushveld of Natal and Transvaal and Rhodesia (*paedulus* group of 'subspecies'). On the lower Orange River, with its riverine vegetation a southern limit, is an isolated ssp. *shortridgei* of the *nigricauda* group of ssp.
4. *Zelotomys woosnami* (Fig. 2, Map 6 (A); Table 2): Strictly endemic to South West Arid and restricted to Kalahari. Rare, on verge of extinction (?). Replaced by *Z. hildegardae* in Southern Savanna to Kenya and north-eastern Congo.
5. *Praomys natalensis* (Fig. 5, Map 22; Table 1, 2, 3): Throughout Southern and Northern Savanna, also occurring in the Palaearctic (Morocco). Marginal in South West Arid from Savanna zone, not south of Lower Orange River, and not in desert or near desert. Disappears where the south-east coastal Savanna meets South-West Cape zone. Found equally in Savanna woodlands and grasslands. Semi-domestic and present distribution possibly dependent on having followed early human population movements.
6. *Praomys verreauxi* (Fig. 4, Map 14; Table 1): Endemic to South-West Cape. Nearest related forms in (?) Angola (*angolensis*), East Africa (*fumatus*) and West Africa (*daltoni*).
7. *Aethomys namaquensis* (Fig. 6, Map 27; Tables 1, 2, 3): Distributed throughout Southern Africa, but has crossed Zambezi into Northern Rhodesia and Nyasaland, and extends into south-western Angola. Lives amongst rocks, in hollow trees or under bark, in aloes or where none of these is available constructs its own haystack shelters (e.g. in parts of the Kalahari).
8. *Aethomys granti* (Map 7; Table 2): Confined to the Karoo. Very closely related to *A. namaquensis*; overlaps with *A. n. centralis*.
9. *Rhabdomys pumilio* (Fig. 6, Map 28; Tables 1, 2, 3): Generally distributed throughout Southern Africa except in certain tropical savanna woodlands. Western semi-desert forms long-tailed; eastern forms short-tailed. Discontinuously distributed north of the Limpopo in montane grasslands to East Africa (Sclater line). Replaces *L. griselda* (see 13) in Zululand and the eastern Transvaal lowveld.
10. *Mus minutoides* (Fig. 6, Map 26; Tables 1, 2, 3): Generally distributed throughout Southern Africa and northwards in Savanna to West Africa.
11. *Dasymys incomtus* (Fig. 5, Map 21; Tables 1, 3): Typical of Savanna and montane areas in Savanna zone to West Africa with a relict ssp. *capensis* in South-West Cape. A swamp rat which appears to be losing its hold in Southern Africa. Funnels down the south-east coast, but still persists at isolated points in Transvaal bushveld and eastern highveld grasslands.
12. *Pelomys fallax* (Fig. 7, Map 36; Table 3): Southern Savanna to East Africa (Sclater line) from north of the Limpopo dry belt. A swamp rat with rather similar habitat requirements to *Dasymys incomtus*.
13. *Lemniscomys griselda* (Fig. 7, Map 32; Tables 2, 3): Typically a species occurring throughout Savanna woodlands to East Africa (Sclater line), which seems to be disappearing from the central Kalahari, but co-distributed with *A. chrysophilus* in the north-west. Funnels down the east coast to southern Natal, much as *A. chrysophilus*.
14. *Acomys* spp. (Fig. 4, Map 15; Tables 1, 3): *A. subspinosus* is confined to South-West Cape. The genus *Acomys* is distributed in the Savanna belt northwards from the northern Transvaal and Mozambique to North Africa and eastwards to Pakistan. Its distribution is somewhat discontinuous, especially in the southern part of its range. Attached to rocky situations.

15. *Saccostomus campestris* (Fig. 6, Map 25; Tables 1, 2, 3): South West Arid and Southern Savanna to Kenya and northern Uganda (somewhat north of Sclater line). In the Southern Savanna of the Transvaal and Natal its distribution pattern clearly reflects its attachment to woodland savanna as against grassland savanna. There are relict populations in the Karoo and in the South-West Cape. (One record from Robertson see Davis 1959, p. 147).

16. *Cricetomys gambianus* (Fig. 7, Map 35; Table 3): Southern and Northern Savanna to West Africa. A Savanna species dependent to some extent on forest fringes. In the Zoutpansberg its sporadic occurrence suggests earlier more extensive forest. In Southern Africa it is represented by a relict ssp. *haagneri* in northern Transvaal (Zoutpansberg and Woodbush) and by other ssp. in Mozambique and Southern Rhodesia (Mt. Selinda).

Subfamily Dendromurinae

17. *Petromyscus collinus* (Fig. 2, Map 5; Table 2): Endemic to South West Arid and restricted to the mountain belt fringing the Namib and relict in the Karoo. Lives in rock crevices.

18. *Steatomys* spp. (Fig. 6, Map 29; Tables 1, 2, 3): (at least three species are suspected, but their identity has not been worked out). The genus *Steatomys* appears to be a Savanna form extending to West Africa. In Southern Africa there is a relict form *pentonyx* in the South-West Cape. The genus encroaches marginally from the Savanna into the north-western South West Arid (cf. *A. chrysophilus* and *L. griselda*).

19. *Dendromus mesomelas* (Fig. 5, Map 20; Tables 1, 3): Southern Savanna woodlands to East Africa (roughly to Sclater line) and funnels down the south-east coast to the South-West Cape.

20. *Dendromus mystacalis* (Fig. 5, Map 24; Table 3): Southern Savanna woodlands to East Africa. Funnels down south-east coast to Transkei. Distribution pattern essentially the same as *D. mesomelas* except that it does not occur in the South-West Cape.

21. *Dendromus melanotis* (Fig. 5, Map 19; Table 1, 3): Southern Savanna grasslands, or grasslands in woodland areas to Congo and East Africa (Sclater line). Funnels down the east coast with an isolated relict ssp. *capensis* in the South-West Cape. Encroaches along the Molopo River bed into South West Arid. More of a grassland species than *D. mesomelas* and *D. mystacalis* but with a similar distribution pattern. (The status of the species is in considerable doubt and some of the records may be based on the longer-tailed *D. nyikae* (see 22)).

22. *Dendromus nyikae* (No Map; Table 3): A rare Savanna woodland species represented by forms in the Transvaal lowveld, Nyasaland, Northern Rhodesia and Angola possibly in West Africa (Mt. Nimba, Ivory Coast; Heim de Balsac and Lamotte 1958).

23. *Malacothrix typica* (Fig. 2, Map 3; Tables 1, 2, 3): Primarily a South West Arid species encroaching marginally into Savanna grasslands (highveld) and into the northern fringe of the South-West Cape.

Subfamily Otomyinae

24. *Otomys laminatus* (Fig. 4, Map 17; Tables 1, 3): Savanna grasslands, sub-montane and coastal, funnelling down to South-West Cape where there is an isolated ssp. *silbibaueri*. Not known north of latitude 23° S. Distribution markedly discontinuous, possibly dying out.

25. *Otomys irroratus* (Fig. 6, Map 30; Tables 1, 2, 3): Southern Savanna highveld, coastal and montane and sub-montane grasslands, continuously distributed to South-West Cape. Isolated on the eastern Escarpment in S. Rhodesia and not occurring north of the Zambezi unless the related *tropicalis* proves to be conspecific. Relict ssp. *coenosus* around Kuruman, and an isolated population in the Karoo within the South West Arid. An example of persistence in 'oases'.

26. *Otomys angoniensis* (Fig. 7, Map 33; Table 3): Southern Savanna woodlands and grasslands to Angola and East Africa. Often confused with *O. irroratus* and *O. tropicalis* and co-exists with them in some areas. Two ssp. groups in Southern Africa: ssp. group *tugelensis* in Natal, Transvaal and extreme northwest Cape; also Mozambique and S. Rhodesia and ssp. *maximus* group in Okavango and south-western Angola (and Elisabethville *vide* Misonne pers. comm.). Distinguished from *irroratus s.l.* by the absence of a clear round posterior petro-tympanic foramen into the bulla and other dental and skull characters. In South Africa e.g. in Transvaal, has a preference for a drier habitat than *irroratus* where the two are found together.

27. *Otomys saundersiae* (Fig. 4, Map 16; Tables 1, 3): South-West Cape relict ssp. *karoensis*; ssp. *saundersiae* in eastern Cape Savanna, north to the Orange River. Sharing morphological characters and habitat preferences with *O. irroratus* and *O. sloggetti*.

28. *Otomys unisulcatus* (Fig. 3, Map 9; Tables 1, 2): South West Arid and marginal encroachment thence into South-West Cape. Confined to the Karoo south of the Orange River except where it has crossed at one point to Luckhoff, O.F.S. Builds large stick shelters in dry watercourses and feeds on Karoo succulents. Occurs throughout the Noorsveld (which is the bulge into the Karoo of the Savanna zone at its junction with the Cape macchia (Fig. 1)) and reaches the coast in Port Elizabeth region. This suggests that the Noorsveld is biotically South West Arid rather than Savanna.

29. *Otomys sloggetti* (Fig. 3, Map 10; Tables 2, 3): Highveld and montane grasslands of Southern Savanna south of latitude 27° S. Highly subspeciated. Distinct ssp. *sloggetti* in Karoo, ssp. *jeppei* in eastern Cape, ssp. *robertsi* tops of Basutoland Mountains, ssp. *turneri* north-eastern O.F.S. and extreme south-eastern Transvaal and ssp. *basuticus* lower altitudes in south-western Basutoland. Also known on spur of Drakensberg (Thabathlope, Natal). Selects rocky habitats.

30. *Parotomys brantsi* (Fig. 3, Map 8; Tables 1, 2): Typical of the South West Arid, occurring throughout the Karoo and extending north of the Orange River up beds of Molopo and Nossob rivers. Marginal encroachment into South-West Cape from the north. Apparently not north of the lower reaches of the Orange River.

31. *Parotomys littedalei* (Fig. 2, Map 4; Table 2): Confined to South West Arid, occurring in the Karoo and Namaqualand with an isolated ssp. *namibensis* in the northern Namib. An example of a discontinuity between northern and southern Namib at Swakopmund. Has a range wider than *P. brantsi* and rather similar burrowing habits but is relatively less numerous where the two species co-exist.

Subfamily Cricetinae

32. *Mystromys albicaudatus* (Fig. 4, Map 16; Tables 1, 3): A Savanna species of highveld and montane grasslands not known north of latitude 26° S., with an isolated population in the South-West Cape. Widely distributed but local in occurrence. An indicator of the boundary between Savanna grasslands and woodlands. Remarkably uniform in size and colour for such a widely distributed species.

Subfamily Gerbillinae

33. *Desmodillus auricularis* (Fig. 2, Map 1; Tables 1, 2, 3): Distributed throughout the South West Arid, marginal in the South-West Cape. Main distribution area ends abruptly on South West Arid/Savanna border apart from isolated populations in grassland Savanna of western Transvaal, north-western and south-eastern Orange Free State.

34. *Gerbillus paebe* (Fig. 2, Map; Tables 1, 2, 3): Throughout the South West Arid and much of South-West Cape. Isolated ssp. *exilis* in eastern Cape coastal dunes and ssp. *coombsi* north of the Zoutpansberg in Savanna zone. Distribution pattern suggestive of a wider past

DISTRIBUTION OF SOUTHERN AFRICAN MURIDAE; NOTES ON THEIR FOSSIL ANTECEDENTS

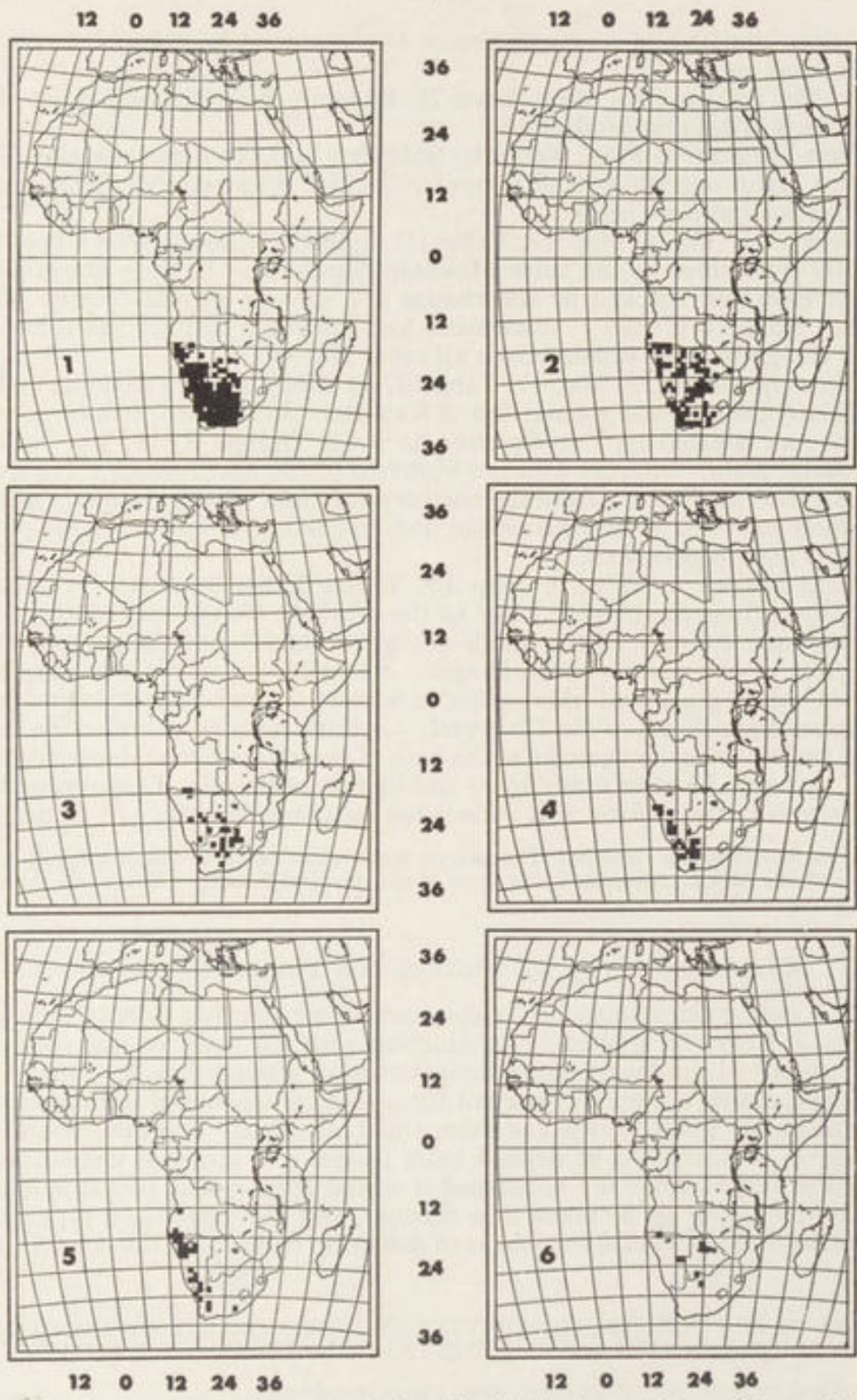


Fig. 2. Maps 1-6. Degree square diagrams showing the distribution of *Desmodillus auricularis* (sp. 33), *Gerbillus paeba* (sp. 34), *Malacothrix typica* (sp. 23), *Parotomys littledalei* (sp. 31), *Petromyscus collinus* (sp. 17) and *Zelotomys woosnami* (sp. 4).

range in a drier climate and a clear indicator of the present boundary between South West Arid and Savanna zones.

35. *Gerbillus vallinus* (No. Map; Table 2): Endemic in South West Arid. Restricted to Namib and Karoo (Bushmanland only).

36. *Tatera inclusa* (No Map; Table 3): Southern Savanna forest margins (?). Affinities with *T. brantsi*, status uncertain. Relict populations in S. Rhodesia (Mt. Selinda) and Mozambique (Gorongosa and elsewhere).

37. *Tatera afra* (Fig. 4, Map 13; Table 1): Endemic in South-West Cape. Distribution almost exactly determined by the Table Mountain Sandstone. Easterly extension along coast towards Port Elizabeth checked by soil change and George-Knysna forests. Distinct from *T. brantsi* but closer to it than *T. leucogaster* and bearing a distinct flea fauna (de Meillon *et al* 1961). Geographically isolated from all other *Tatera*.

38. *Tatera brantsi* (Fig. 3, Map 11; Tables 2, 3): Sandy areas in Savanna and South West Arid, particularly the highveld grasslands and Kalahari. Isolated ssp. *miliaria* in sandy pockets in the Karoo; an isolated ssp. *namaquensis* on lower Orange River; ssp. *ruddi* isolated in Zululand coastal plain. Intrudes into the bushveld of the north-western Transvaal with the Waterberg Sandstone. Extends from the northern Kalahari up the Zambezi valley to Mongu. Prefers a lighter soil than *T. leucogaster* and does not extend from the fringes of the Kalahari westwards as *T. leucogaster* does.

39. *Tatera leucogaster* (Fig. 3, Map 13; Tables 2, 3): Southern Savanna woodlands and the Kalahari from the Orange River to the southern Congo and southern Tanganyika. Absent from dune country in the south-western Kalahari but penetrating the subdesert scrub and grass of the north-western fringes. An indicator of the boundary between Pole Evans' (1936) 'mixed grass' and 'short grass' in western Orange Free State and between bushveld and highveld grasslands of the Transvaal. Co-exists with *T. brantsi*, often using the same warrens but prefers to make burrows at the base of bushes and small trees rather than in the open like *T. brantsi*. Lives in sandy loam and lighter loam soils. Geographical variation in colour and size is fairly uniform and no isolated distinct subspecies can be defined.

(Note on the nomenclature employed: The generic and specific names are in conformity with the current revision of Southern African Muridae being done at the Medical Ecology Centre and the reasons for the changes are to be published elsewhere.)

CLASSIFICATION OF THE DISTRIBUTION PATTERNS OF MURIDAE

A general indication of some of the distribution patterns has already been given and the maps in Fig. 2-7 may be studied in conjunction with the notes on the species to gain an idea of the variety. In order to group the patterns an attempt has been made to compile a key—admittedly rather crude in its present form—which it is hoped in due course to expand to include the rest of the Rodentia and other small mammals. The subdivisions of the biotic zones will have, of course, to be defined more precisely in terms of vegetation types etc.

In so far as the Muridae are concerned it would appear that available habitats are the basic distribution factor to be taken into account, and that vegetation type, soil and topography—in that order—provide the means of definition better than the more 'distant' climatic factors.

DRAFT KEY* TO THE DISTRIBUTION PATTERNS OF MURIDAE OCCURRING IN SOUTHERN AFRICA (SOUTH OF KUNENE-ZAMBEZI AS DEFINED ON p. 57)

1	Confined to Southern Africa (with some minor crossings)	..	..	..	..	2
	Not confined to Southern Africa	..	..	..	..	20
2 (1)	Generally distributed throughout Southern Africa (Map 27)	..	..	<i>A. namaquensis</i>	(sp. 7)	3
	Not generally distributed in Southern Africa	..	..	..	..	3

DISTRIBUTION OF SOUTHERN AFRICAN MURIDAE; NOTES ON THEIR FOSSIL ANTECEDENTS

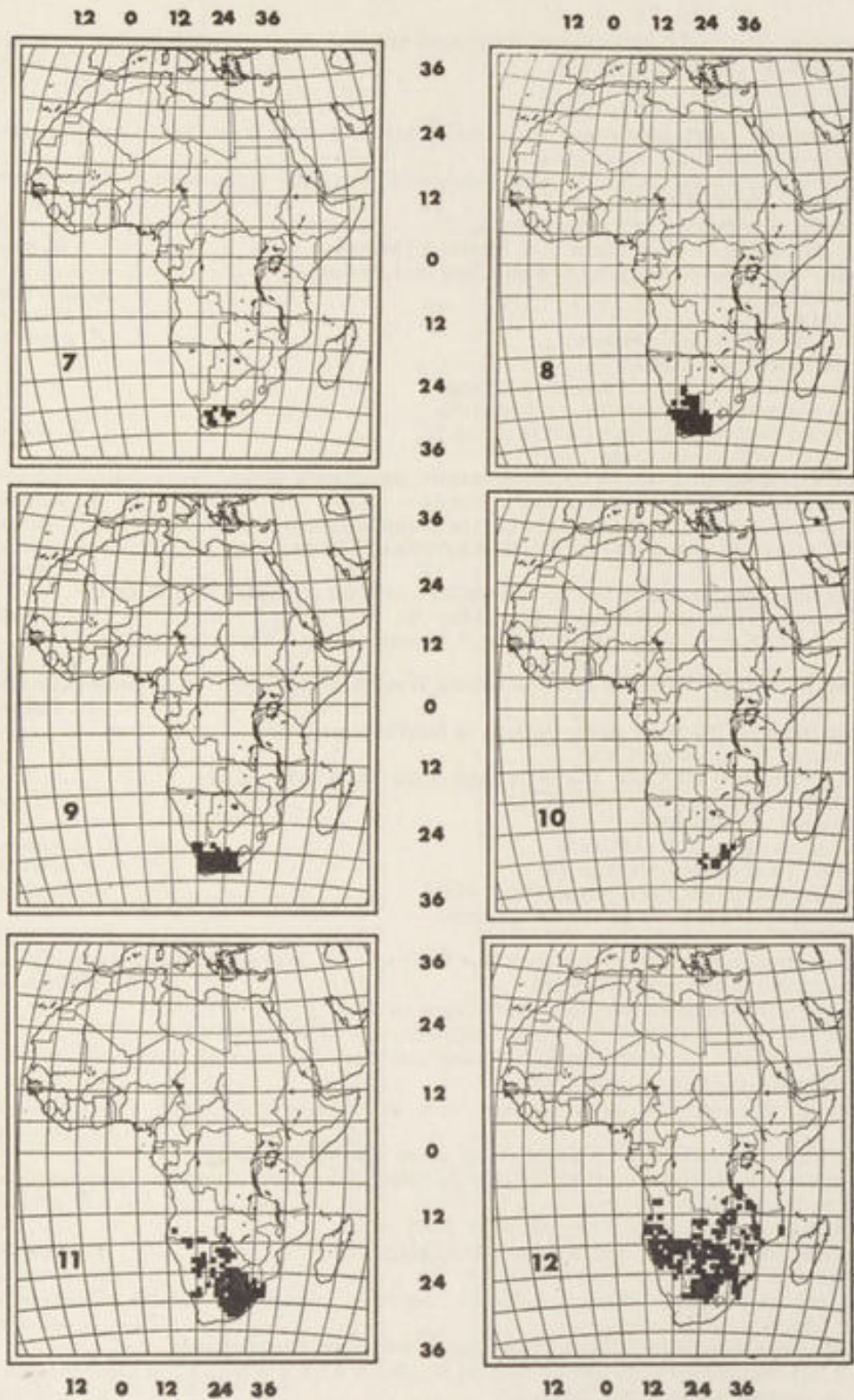


Fig. 3. Maps 7-12. Degree square diagrams showing the distribution of *Aethomys granti* (sp. 8), *Parotymos brantsi* (sp. 30), *Otomys unisulcatus* (sp. 28), *O. sloggetti* (sp. 39), *Tatera brantsi* (sp. 38) and *T. leucogaster* (sp. 39). *T. leucogaster* probably also occurs in eastern Angola and throughout Mozambique, as yet incompletely surveyed.

3 (2)	About equally distributed in South West Arid and Savanna, absent from Karoo proper and South-West Cape (Map 11)	.. .. .	<i>T. brantsi</i>	(sp. 38)
	Not so distributed	.. .. .	.. .. .	4
4 (3)	Primarily confined to South West Arid	.. .. .	.. .. .	5
	Not primarily confined to and may not occur in South West Arid; may occur in South-West Cape and/or Savanna	.. .. .	.. .. .	14
5 (4)	Generally distributed in South West Arid, with marginal extensions or relict ssp. in South-West Cape and Savanna	.. .. .	.. .. .	6
	Restricted distribution in South West Arid	.. .. .	.. .. .	8
6 (5)	Relict ssp. in South-West Cape and Savanna (Map 2)	.. .. .	<i>G. paeba</i>	(sp. 34)
	Marginal extensions into South-West Cape and Savanna	.. .. .	.. .. .	7
7 (6)	Common (Map 1)	.. .. .	<i>D. auricularis</i>	(sp. 33)
	Rare (Map 3)	.. .. .	<i>M. typica</i>	(sp. 23)
8 (5)	Restricted to Kalahari (Map 6)	.. .. .	<i>Z. woosnami</i>	(sp. 4)
	Not restricted to Kalahari	.. .. .	.. .. .	9
9 (8)	Restricted to western Escarpment and fringes	.. .. .	.. .. .	10
	Not so restricted, but not absent therefrom	.. .. .	.. .. .	12
10 (9)	Associated with mountainous areas (Map 5)	.. .. .	<i>P. collinus</i>	(sp. 17)
	Associated with sandy areas	.. .. .	.. .. .	11
11 (10)	Common, an isolated ssp. in northern Namib, apparently absent from southern Namib immediately south of Swakopmund (Map 4)	.. .. .	<i>P. littledalei</i>	(sp. 31)
	Very rare, locally common, found in northern and southern Namib (No Map)	.. .. .	<i>G. vallinus</i>	(sp. 35)
12 (9)	Mainly restricted to the Karoo, extending north of Orange River into southern Kalahari (Map 8)	.. .. .	<i>P. brantsi</i>	(sp. 30)
	Mainly restricted to Karoo but not extending to or just crossing Orange River	.. .. .	.. .. .	13
13 (12)	Confined to Upper and Great Karoo (Map 7)	.. .. .	<i>A. granti</i>	(sp. 8)
	Throughout Karoo and fringes and just across Orange River to Luckhoff (Map 9)	.. .. .	<i>O. unisulcatus</i>	(sp. 28)
14 (4)	Common to parts (Upper Karoo) of South West Arid and parts of adjoining Savanna (Map 10)	.. .. .	<i>O. sloggetti</i>	(sp. 29)
	Absent from South West Arid, present in South-West Cape	.. .. .	.. .. .	15
15 (14)	Endemic in South-West Cape	.. .. .	.. .. .	16
	Relict in South-West Cape and occurring in Savanna grasslands	.. .. .	.. .. .	17
16 (15)	Distributed in sandy areas (Map 13)	.. .. .	<i>T. afra</i>	(sp. 37)
	Distributed in hilly areas	.. .. .	.. .. .	17
17 (16)	Confined to rocky sites (Map 15)	.. .. .	<i>A. subspinosus</i>	(sp. 14B)
	Confined to grass-scrub (Map 14)	.. .. .	<i>P. verreauxi</i>	(sp. 6)
18 (15)	Occurring east of the Escarpment (Map 17)	.. .. .	<i>O. laminatus</i>	(sp. 24)
	Occurring on both sides of the Escarpment	.. .. .	.. .. .	19
19 (18)	Confined to the eastern Cape (Map 16)	.. .. .	<i>O. saundersiae</i>	(sp. 27)
	Occurring northwards from eastern Cape to Transvaal, Natal and Basutoland highveld and montane grasslands (Map 18)	.. .. .	<i>M. albicaudatus</i>	(sp. 32)
20 (1)	Southern and Northern Savanna and fringes to West Africa	.. .. .	.. .. .	21
	Southern Savanna towards or beyond equator, not to West Africa	.. .. .	.. .. .	27
21 (20)	Reaching South-West Cape down 'tropical corridor' or occurring there	.. .. .	.. .. .	22
	Not reaching the South-West Cape	.. .. .	.. .. .	25
22 (21)	Marginal invasion of extreme east end of South-West Cape from Savanna (Map 22)	.. .. .	<i>P. natalensis</i>	(sp. 5)
	Relict ssp. or populations in South-West Cape (peninsula area)	.. .. .	.. .. .	23
23 (22)	Not west of Natal Drakensberg, absent in South West Arid, funnels down south-east coast Savanna (Map 21)	.. .. .	<i>D. incomtus</i>	(sp. 11)
	Occurring in or marginal to South West Arid	.. .. .	.. .. .	24
24 (23)	Generally distributed in South West Arid (Map 26)	.. .. .	<i>M. minutoides</i>	(sp. 10)
	Marginal in South West Arid (Map 29)	.. .. .	<i>Steatomys</i> spp.	(sp. 18)
25 (21)	Reaching Uitenhage down 'tropical corridor', east of Natal Drakensberg (Map 23)	.. .. .	<i>T. dolichurus</i>	(sp. 1)
	Not further south than eastern Transvaal or southern Mozambique	.. .. .	.. .. .	26
26 (25)	Relict ssp. discontinuously distributed (in Southern Africa at least) ? in association with past or present forest areas (Map 35)	.. .. .	<i>C. gambianus</i>	(sp. 16)
	Relict ssp. in Transvaal lowveld, rare (No Map)	.. .. .	<i>D. nyikae</i>	(sp. 22)
27 (20)	Southern Savanna northwards through Sudan to North Africa (Map 15)	.. .. .	<i>Acomys</i> spp.	(sp. 14A)
	Southern Savanna northwards, not to N. Africa	.. .. .	.. .. .	28

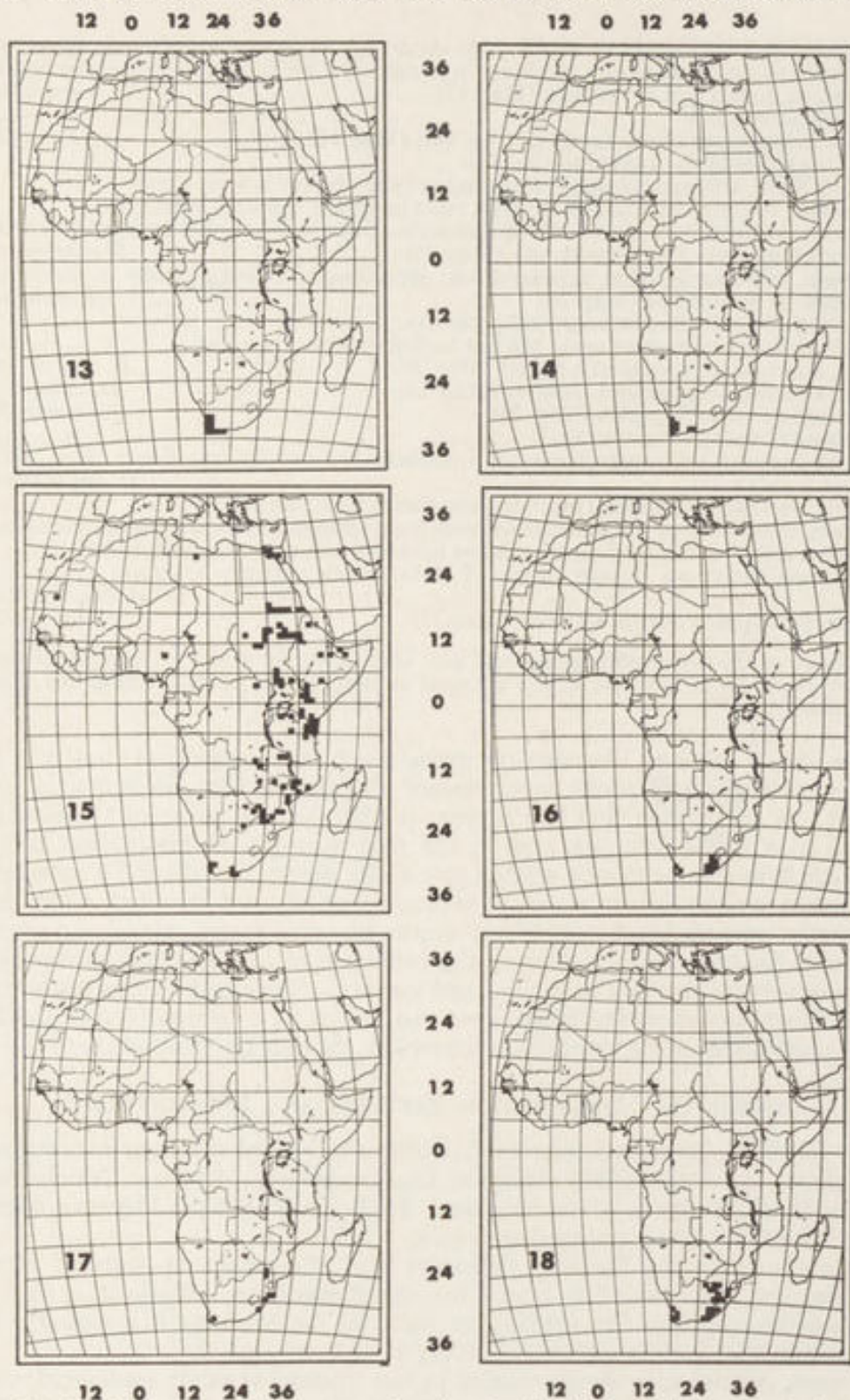


Fig. 4. Maps 13-28. Degree square diagrams showing the distribution of *Tatera afra* (sp. 37), *Praomys verreauxi* (sp. 6), *Acomys* spp. (sp. 14), *Otomys saundersiae* (sp. 27), *O. laminatus* (sp. 24) and *Mystromys albicaudatus* (sp. 32). The species of the genus *Acomys* await definition. The records in the South-West Cape are of the isolated species *A. subspinosus*.

28 (27)	Not reaching Sclater line; in South West Arid and Savanna from Orange River to southern Congo/Tanganyika (replaced in Tanganyika by <i>T. robusta</i> which goes north and west to Sudan and W. Africa) (Map 12)	.. .. .	<i>T. leucogaster</i>	(sp. 39)
	Reaching Sclater line	.. .. .	.. .. .	29
29 (28)	Not occurring south of the Limpopo Dry Belt (Map 36)	.. .. .	<i>P. fallax</i>	(sp. 12)
	Extending south of the Limpopo Dry Belt	.. .. .	.. .. .	30
30 (29)	In South West Arid and Savanna; marginal or relict in South-West Cape	.. .. .	.. .. .	31
	In Savanna, marginal in South West Arid, relict or absent in South-West Cape	.. .. .	.. .. .	32
31 (30)	Continues northwards from woodland and semi-desert, in woodland Savanna to north (northern Uganda) of the Sclater line (Map 25)	.. .. .	<i>S. campestris</i>	(sp. 15)
	Continues northwards from grassland and semi-desert discontinuously in montane grasslands to Sclater line (Map 28)	.. .. .	<i>R. pumilio</i>	(sp. 9)
32 (30)	Funnelling down south-east coast to South-West Cape	.. .. .	.. .. .	33
	Funnelling down south-east coast but not to South-West Cape	.. .. .	.. .. .	34
33 (32)	Mainly attached to woodland habitats (Map 20)	.. .. .	<i>D. mesomelas</i>	(sp. 19)
	Mainly attached to grassland habitats (Map 19)	.. .. .	<i>D. melanotis</i>	(sp. 21)
34 (32)	Funnelling down to Transkei (Map 24)	.. .. .	<i>D. mystacalis</i>	(sp. 20)
	Funnelling down to southern Natal	.. .. .	.. .. .	35
35 (34)	Crossing westwards through Transvaal woodland but not far into South West Arid (Kalahari) (Map 33)	.. .. .	<i>O. angoniensis</i>	(sp. 26)
	Crossing westwards through Transvaal woodlands to Kalahari	.. .. .	.. .. .	36
36 (35)	Generally distributed in Kalahari northwards from Orange River (Map 34)	.. .. .	<i>T. paedulus</i>	(sp. 3)
	Restricted distribution from north-western Savanna into north-western Kalahari	.. .. .	.. .. .	37
37 (36)	Relict populations on eastern fringe of Kalahari (Kuruman, Vryburg) (Map 31)	.. .. .	<i>A. chrysophilus</i>	(sp. 2)
	Relict populations in central Kalahari (Map 32)	.. .. .	<i>L. griselda</i>	(sp. 13)

*The characteristics of the distribution pattern of any species can be noted by reading the key backwards from the key numbers in brackets in the lefthand column to the corresponding key numbers in the righthand column.

From the above key and distribution maps much can be gleaned, but it is beyond the scope of the present paper to probe much deeper into the way the present situation has been brought about. It is obvious that the present distribution of some of the Savanna species can be related to a wider Savanna area in the past during a pluvial period and, *vice versa*, that South West Arid species can be related to a wider desert area during a nonpluvial period. Equally important are the various stages of evolutionary advance revealed in the attainment of species, subspecies and 'isolated population' status by some forms; clearly an attempt can be made to account for these by considering the influence of climatic fluctuations and tectonic and other topographical changes on spread and survival. Some indications of the evolutionary history of the Muridae during the Pleistocene can be got by a comparison of the fossil murid fauna of the australopithecine deposits, incomplete though our knowledge is.

PRESENT DAY DISTRIBUTION PATTERNS AND PALAEOECOLOGY

It is now generally conceded that the Cricetinae have had a longer evolutionary history than the Murinae. Lavocat (1959) allies the Dendromurinae with the Cricetinae and traces their origin to the cricetodonts of the Miocene. He believes that the Murinae came later and originated in Asia, also from cricetodont stock.

Fossil murids from the Tertiary (Miocene and Pliocene) are scarcely represented in Southern Africa, but the record is better for the Pleistocene. While it is thus difficult at present to trace the origin of the subfamilies back to the Miocene it is possible to compare Pleistocene genera and species with those living at present.

Recent work on the microfauna found in the 'rodent breccia' associated with the australopithecine cave deposits in the north-west Cape (Taung) and the Transvaal (Sterkfontein area and Makapan) is beginning to produce a clearer picture of the species assemblages. The pioneer work of Broom has been furthered in recent years (Lavocat 1955, 1957; Davis

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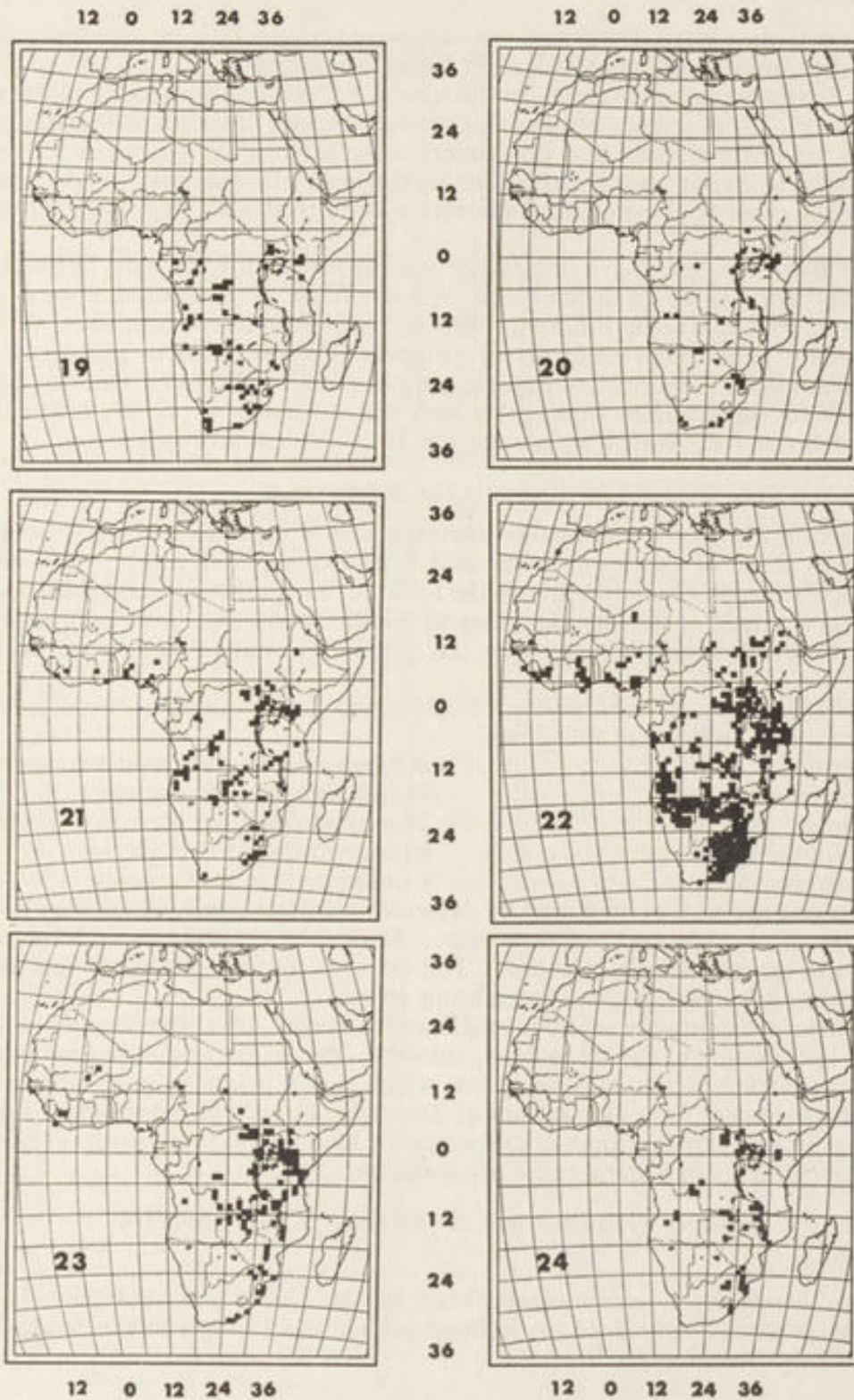


Fig. 5. Maps 19-24. Degree square diagrams showing the distribution of *Dendromus melanotis* (sp. 21), *D. mesomelas* (sp. 19), *Dasymys incommisus* (sp. 11), *Praomys natalensis* (sp. 5), *Thamnomys dolichurus* (sp. 1), and *Dendromus mystacalis* (sp. 20).

1959 and in press; de Graaff 1961) and we can now start to link up the lower Pleistocene murids (and other small mammals) with their living counterparts.

The early Pleistocene murids were, on the whole, not unlike those living in the same areas at the present day. Some species are clearly 'chronospecies', differing little from present day species; others are quite distinct and no modern counterparts are known, while others bear some resemblance to living species but differ in size and other details which suggest that a certain amount of subspeciation or even speciation combined with some extinction has intervened.

No subfamily of the Muridae living today is unrepresented in the early Pleistocene fauna, but the relative proportions of species and of individuals of a species, appear on present evidence to have been markedly different. Broom noted that the Cricetinae and Otomyinae were the dominant subfamilies in terms of numbers of individuals in the breccia. This is certainly the case in one reasonably complete sample of the microfauna that has been studied (see Davis 1959 for preliminary findings) which was collected by C. K. Brain from 18 ft. of decomposed breccia excavated at Kromdraai B in the Sterkfontein area.

THE KROMDRAAI B MURIDAE

This collection has now been worked through and is used here to make tentative comparisons between some of the fossil forms and their living counterparts. The discussion is admittedly speculative, since the identity of the fossil forms is difficult to establish on maxillary and mandibular fragments; it will take years of critical study and more complete specimens before it will be known whether even the few forms referred to here have been correctly interpreted.

The relative numbers, by subfamilies, of individuals and of number of species represented in the Kromdraai B collection are as follows:

Cricetinae	..	..	..	..	287 individuals of at least two species
Otomyinae	..	..	..	..	74 individuals of one species
Murinae	..	..	..	..	27 individuals of at least five species
Gerbillinae	..	..	..	..	10 individuals of two species
Dendromurinae	..	..	..	..	4 individuals of one species

The Cricetinae are now represented by *Mystromys albicaudatus*, which may be designated a chronospecies *M. hausleitneri—albicaudatus*. The other cricetine (a small species, larger than *M. darti*) is extinct (Davis in press). The *Otomys* (*O. gracilis*) no longer exists in the area, being replaced by two larger, near sibling species.

The Murinae are represented by a small and a larger *Mus*, the small one probably a chronospecies terminating in the living *M. minutoides*. The larger species has no living counterpart in Southern Africa except *Mus musculus*, which was introduced in comparatively recent times. Then there appear to be two species of *Dasymys*. *D. bolti* is apparently a chronospecies *bolti-incomtus*. The Dendromurinae are represented by a small *Dendromus*. The Gerbillinae have at least one species of *Tatera* and a *Desmodillus*.

PRESENT DISTRIBUTION OF EXTANT 'CHRONOSPECIES'

Subfamily Cricetinae

Mystromys hausleitneri—albicaudatus (Map 18, sp. 32): Widely but sparsely distributed in the Savanna grassland zone with an isolated population (? ssp.) in the South-West Cape. It still occurs in the Sterkfontein area.

Subfamily Otomyinae

Otomys (*Palaeotomys*) *gracilis*—? *O.* (*Myotomys*) *sloggetti turneri* (See Map 10, sp. 29). Confined to the north-eastern Orange Free State with related but distinct ssp. *robertsi* (Maluti

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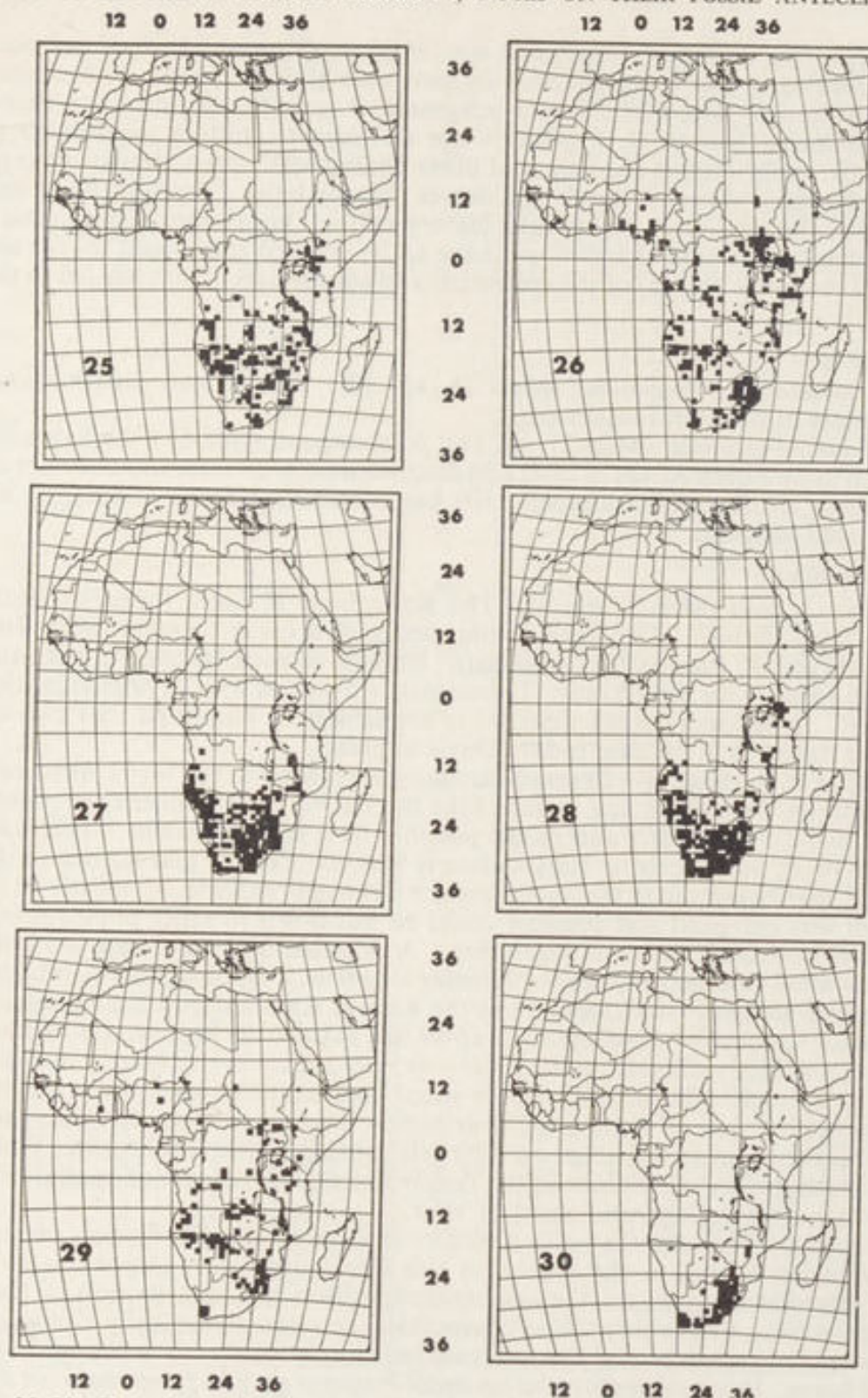


Fig. 6. Maps 25-30. Degree square diagrams showing the distribution of *Saccostomus campestris* (sp. 15), *Mus minutoides* (sp. 10), *Aethomys namaquensis* (sp. 7), *Rhabdomys pumilio* (sp. 9), *Steatomys* spp. (sp. 18) and *Otomys irroratus* (sp. 25). The species of the genus *Steatomys* await definition. The record in the South-West Cape are of the isolated form *S. pentonyx*. At least two species are represented in the Savanna zone.

Mountains), ssp. *jeppeii* (eastern Cape) and spp. *sloggetti* (Karoo). It does not occur in the Sterkfontein area now, but is represented by two near sibling species *O. irroratus* and *O. angoniensis*. Although placed in different subgenera *O. gracilis* may prove to be nearer the living *O. angoniensis* than to *O. irroratus* since *O. sloggetti* and *O. angoniensis* (although differing in their molar lamina formula and other characters) have a similar arrangement of foramina for the entry of blood vessels and nerves into the bulla. There is clearly much to be done to unravel the post-early Pleistocene history of the Otomyinae, and climatic changes, with the attendant vegetation changes, will have to be invoked to account (a) for the present distribution of the genus and (b) of the speciation and subspeciation that has led to the present variety.

Subfamily Murinae

Mus cf. *minutoides*—*minutoides* (Map 26, sp. 10): Pan-African distribution and still occurs commonly in the Sterkfontein area.

Dasymys bolti—*incomtus* (Map 21, sp. 11): A swamp rat, typical of the Savanna, though its distribution in Southern Africa is local and discontinuous. *D. incomtus* does not now occur in the immediate vicinity of Sterkfontein, but has been found north of Pretoria and in the eastern Transvaal highveld.

Subfamily Gerbillinae

Tatera sp.—*brantsi* (Map 8, sp. 30): The Kromdraai B. fossil form is slightly smaller than present day *T. brantsi*. Two near sibling species now occur together in the Sterkfontein area: *T. brantsi* and *T. leucogaster* (= *schinzi*). Both have been trapped in the same warren a few hundred yards from Swartkrans. *T. leucogaster* overlaps with *T. brantsi* in the Kalahari and its fringes. When more fossil material is available it is suspected that two co-existing species will be found as is the case today (Davis in press).

Desmodillus cf. *auricularis*—*Desmodillus auricularis* (Map 1, sp. 33): This record is based on three mandibles, one with a first molar. Like the *Tatera*, the specimens are slightly smaller than present day *D. auricularis* and might possibly be a large *Gerbillus*. The nearest point of occurrence of *D. auricularis* to Sterkfontein is between Zeerust and Koster in the western Transvaal and near Hoopstad in the north-western Orange Free State. Evidently its occurrence at Kromdraai was marginal and possibly could be put down to relict populations surviving from a drier period with a Karoo vegetation. A possible limiting factor is its staple food plant—the so-called 'dubbeltjie' (seeds of *Tribulus terrestris*, Zygophyllaceae)—which flourishes around pans and along dry watercourses in the Karoo, Kalahari and their fringes.

Dendromus ? *antiquus*—? *melanotis* (Map 19, sp. 21): Of the four species of *Dendromus*—*mesomelas*, *mystacalis*, *melanotis* and *nyikae*—*D. mesomelas* is the largest and has not yet been found as a fossil. The other three are small and distinctions on tooth characters have not yet been worked out. Furthermore distribution data are somewhat scanty, so that it is not possible to comment at this stage on their relationship to the fossil forms. Since Lavocat now groups them and the Cricetinae in the family Cricetidae they are of special interest from the evolutionary and phylogenetic point of view.

It can thus easily be seen that with a picture in mind of the distribution patterns of even the living Muridae related to the species in this single deposit, it is possible to detect the influence of climatic changes on the species-composition and distribution of the ancestors of the living species. At the same time competition between ecologically equivalent species, such as between the cricetines and the murines, has clearly resulted in a change in the balance of the murid fauna. It is noteworthy that no small *Praomys* such as *P. verreauxi* or *P. natalensis* (*Myomys* and *Mastomys* auctt.) has yet been certainly identified in the lower Pleistocene. Competition also seems to have been at work to restrict progressively the distribution of such forms as *Dasymys*, which are now sparsely and discontinuously distributed in Southern

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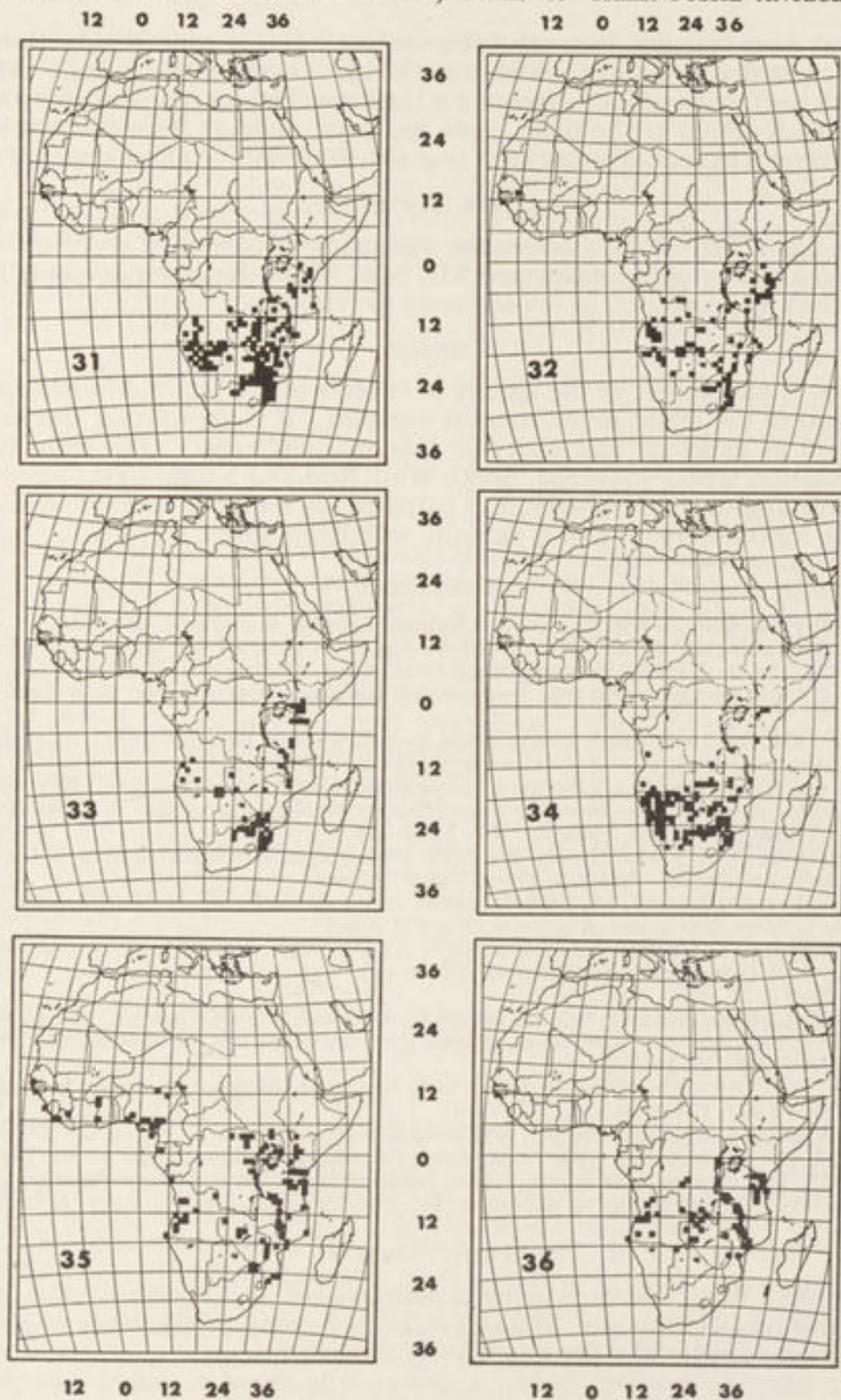


Fig. 7. Maps 31-36. Degree square diagrams showing the distribution of *Aethomys chrysophilus* (sp. 2), *Lemniscomys griselda* (sp. 13), *Otoymys angoniensis* (sp. 26), *Thallomys paedulus* (sp. 3), *Cricetomys gambianus* (sp. 16) and *Pelomys fallax* (sp. 12). *C. gambianus* is continuously distributed from east to west Africa (literature not fully searched for exact localities).

Africa and must have formerly been much more abundant and widespread. *Otomys* species and *Dasymys* co-existed and still co-exist, but *Otomys* is even more dominant over *Dasymys* forms now than the fossil evidence suggests for the lower Pleistocene. Possibly *Dasymys* was already losing its foothold at the time. This gets some support from the fact that a close relative of *Dasymys* is extinct, whereas most (but not all) species of *Otomyinae* are flourishing.

ACKNOWLEDGEMENTS

I wish to thank Mr. C. G. Coetzee for assistance in compiling the distribution data, Miss J. Walker for copying the maps and Mr. Max Ulrich for photographing them. This paper is published by permission of the Secretary for Health.

SUMMARY

The degree of attachment of the species of rodents of the family Muridae (occurring in Southern Africa) to the major biotic zones is analysed. It is shown that species-occurrence can be classified as endemic, near-endemic, marginal and relict. The main biotic zones, (based on vegetation types)—Savanna, South West Arid and South-West Cape—are further subdivided according to murid distribution patterns. A tentative attempt to link the fossil Muridae of the australopithecine cave deposits with living forms is made.

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DISCUSSION

Dr. Winterbottom: With reference to relict *Saccostomus* at Robertson, is it relevant that considerable areas in this district are karoid and many of the birds of Robertson are actually Karoo species and not South-West Cape forms.

Mr. Davis: It might be relevant, but we know so little about it, and this particular species is very plastic as regards its environment.

Dr. Bigalke: Murid distribution seems to be so neatly tied up with environment as to suggest that this group has been constant for a very long time and not much influenced by man.



Davis, D H S. 1962. "Distribution patterns of Southern African Muridae with notes on some of their fossil antecedents." *Annals of the Cape provincial museums* 2, 56–76.

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